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ABSTRACT

This paper suggests that there are ways to organize the literature, both within music and in related fields of study, so that the interested professional can engage in an active organized study of creative thinking in music. There are also ways of defining musical behaviors that are indicative of creative thinking in children as well as adults. Additionally, it might be possible to suggest a model of creative thinking in music that might serve as a basis of discussion and perhaps further research, and finally actually to measure creative behavior in music. This paper reviews studies from the general literature on creative thinking and music literature specifically. This is not a comprehensive review, but rather is aimed at those writings that hold particular importance for content and construct validity in assessment design. Attempts to construct a measure of creative thinking based on these constructs are identified. Measure of Creative Thinking in Music (MCTM) was developed with the belief that creative thinking ability in music might be measured early in a child's musical development, between the ages of 6 and 10. MCTM is a set of structured activities that must be given on an individual basis. It evaluates expressive and productive levels of creative products by engaging children in improvisatory and quasi-improvisatory musical activities with simple but expressive musical instruments. A definition of creative thinking in music, linked to a conceptual model representing the thinking process conclude the paper. Contains 51 references. (DK)

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Creative Thinking in Music: The Assessment Question

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Creative Thinking in Music: The Assessment Question

Peter R. Webster

There are few topics in music teaching and learning that are as confusing, challenging and meaningful as the study of creative thinking in music. Such a meeting as this is timely for it comes at a moment when our discipline is maturing in terms of philosophy, practice, and research base. For the first time, we are beginning to consider some of the most fundamental issues not from only a basis of anecdote and opinion, but from reason and research. We are continually informed by the revolution in psychology which has become known as cognitive science and we are facing advances in sound production technology that offer exciting frontiers as well as important new problems. Considered against this backdrop of opportunity, we find ourselves at this conference confronting perhaps the most important issue of all. For it is because of creative thinking ability that our art--indeed all art--flourishes. On behalf of those professional educators that spend time on the study and practice of creative thinking in music, I wish to thank the University of South Florida for its vision in sponsoring this event. We will not solve all of the issues that confront the study of creative thinking, but we will surely advance our understanding and perhaps encourage more research and teaching on creativeness. Our schools need it.

There are many in our profession who feel that the isolated study of such a topic is simply not worthy of consideration since what we do with children everyday is "creativity." "After all, isn't that what we do when we teach music?" My response to this is, "Maybe ...." Much depends on just how we engage our children's thinking about music. More often than not, we tend to teach our art only by rule and by rote. Because of the enormous pressures placed on us for polished musical productions, because of the need (often self-imposed) to show the results of factual learning achievements in music, and because of our own lack of creative thinking about teaching strategy, we tend to engage children in scripted procedures that produce what might on the outside seem like "creativeness" but really amount to unimaginative exercises in sound production and cognitive learning. In general, music teaching is really quite good at what might be termed "discipline-based instruction." It is somewhat ironic that, as our colleagues in the visual arts are debating the enhancement of discipline-based instruction in art as promoted by the Getty Foundation, we in music seem to suffer far too much from this approach. We would do well to work toward the goal of original music hanging from the refrigerator door at home or sounding from the boom-box of the second floor bedroom.

Please do not misunderstand. I do not advocate that we lessen our efforts to teach knowledge about music. In fact, research has shown repeatedly that the more we know about music in terms of conceptual understanding **and** the more that we can internally hear music and music's movement through time, the more creative we can become. But I do agree with Sherman when he says that there is a difference between **knowing** music and being **knowledgeable about** music (Sherman, 1971, p. 19). Knowing music is evidenced by active engagement in creative activity: composing, performing and/or improvising, analyzing through deep and active listening--in short, engagement in our art on a level that is difficult to put into words. Being knowledgeable about music is demonstrated by talking or writing about the art.

I believe deeply that knowing music is the ultimate aim of music teaching and learning and that the road to that end leads straight through the heart of creative thinking in music--straight through the heart of musical imagination.

There are still others in our profession that maintain the active, organized study of such a topic is doomed to failure before the start because of its vast and unspecified meaning. Certainly the field is vast, but there are ways to organize the literature, both within music and in related fields of study so that the interested professional can make some headway. It seems to me that there are also ways of defining musical behaviors that are indicative of creative thinking--not just in adults, but in children as well. Additionally, it might be possible to suggest a model of creative thinking in music that might serve as a basis of discussion and perhaps further research. Finally--and most important for this talk today--it may be possible to (perish the thought) actually measure creative behavior in music!

In the minutes that follow, allow me to lead you through some of the bases of the assessment question by reviewing studies from the general literature on creative thinking and then the music literature specifically. This will not be a comprehensive review, but rather be aimed at those writings which hold particular importance for content and construct validity in assessment design. Secondly, I will share with you some of my attempts to construct a measure of creative thinking based on these constructs and will demonstrate the measure with video-taped excerpts from past studies. I will conclude by summarizing what this might mean for a definition of creative thinking in music, and in so doing, linking this to a conceptual model that presumes to represent the thinking process itself.

Bases in the Literature

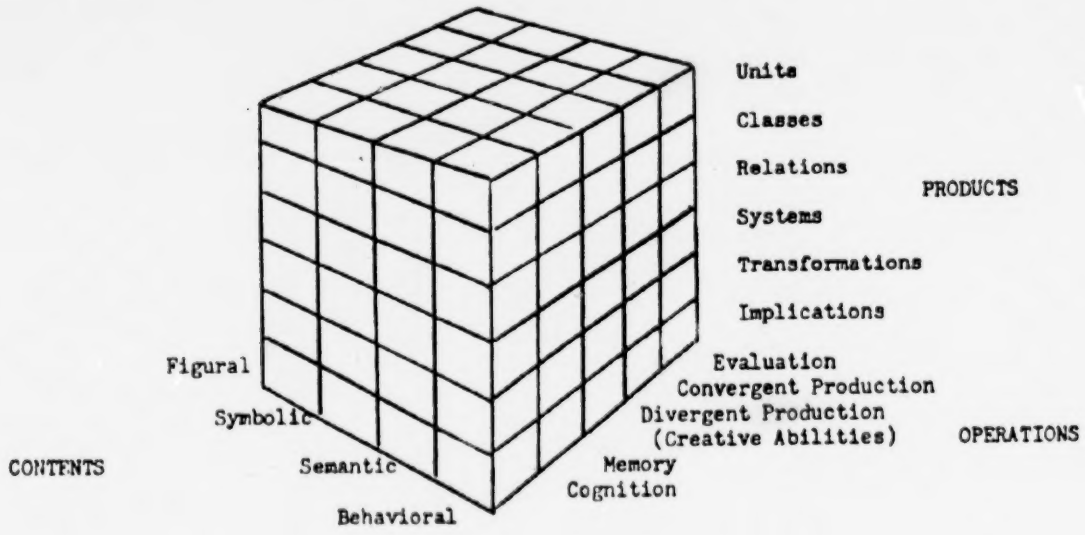
Just what do we know from the literature that might help us in addressing assessment? The first step is to distinguish between the literature that deals with music content and non-music writings that can be found in psychology and--more recently--cognitive science.

Non-Music Literature

Among the competing theories in psychology, those related to the study of thinking in terms of knowing and perception (what has become known as cognitive psychology and in its more recent and expanded context as cognitive science) seem to hold the most import for assessment efforts in creative thinking. Other theories based on behavioristic and psychoanalytic premises fall far short in fundamental ways in explaining the complexity and unpredictability of the creative act (Hargreaves, 1986, pp. 153-158).

Perhaps the most influential cognitive approach for music assessment has stemmed from the factor of intellect work of Guilford in the 1950's and 1960's (Guilford, 1967). Guilford's Structure of Intellect Model (see Fig. 1) was built on the philosophical belief that intelligence is not a single dimension phenomenon that can be properly assessed with a single measure and represented by a single score, but rather a complex of several factors requiring a host of measures to accurately assess.

Figure 1
Guilford's Structure of Intellect Model



This notion was not new with Guilford and can be traced back to the very earliest writings on intelligence from the beginnings of psychology itself, if not before. However, Guilford's model is perhaps the most expansive view of multiple factors, hypothesizing the existence of 120 individual skills that result from the intersection of the content, mental operations and resultant products of the thinking process. Quantitative verification of these factors is another story. Guilford and his fellow researchers relied heavily (if not exclusively) on the statistical procedure of factor analysis as a means of verification. This complicated and sometimes overly-subjective procedure, together with other conceptual problems related to this work, has not influenced current professionals to endorse Guilford's model, however his contribution to our expanded thinking about the nature of intellect cannot be disputed. His stressing of divergent thinking skills--those skills that require the search for many solutions to a given problem or task--as well as convergent, single answer skills has resulted in a number of paper and pencil measures of verbal (semantic) and figural thinking based on the concepts of fluency, flexibility, elaboration and originality.

It was on this platform that ance created his now well known tests of creative thinking using words, figures, and sounds (Torrance, 1966). In his verbal measure, for instance, subjects are presented with common objects (e.g. boxes, stuffed animals) and situations (sometimes improbable situations) and asked for the solution to tasks. The responses are measured according to fluency (sheer number), flexibility (category in which the response best fits), and originality (defined as a function of uniqueness).

Barron used a similar approach in his studies of the verbal thinking abilities of creative persons (Barron, 1988). His Symbolic Equivalence Test presents a stimulus image, for example "leaves being blown in the wind." The subject is asked to think of metaphors or

symbolic equivalent images. In response to the leaves question, the following might be possible:

- people fleeing chaotically in the face of armed aggression
- handkerchiefs being tossed about inside a clothes dryer
- chips of wood borne downstream by a swiftly eddying current.

Such responses are evaluated by factors of fluency and originality.

It is interesting that this multiple factor approach to intelligence assessment continues today in a new guise. Howard Gardner's acclaimed book, Frames of Mind (Gardner, 1983), postulates the existence not of specific skills that might be tested with paper and pencil tests, but rather of whole constellations of abilities that, for him, define seven separate intelligences--one of which is music. Again, this approach is not new. His chapter on music, for me, misses the mark in many important ways, but Gardner does succeed in grounding his particular view of intellect on a variety of literatures: experimental, clinical, biological, developmental, philosophical and artistic. In so doing, he continues this expanded view of human intellect, transporting it into the contemporary literature of cognitive science.

These views that take a "trait" or "factor" approach are important for assessment efforts in the arts. As we shall see shortly, they offer an attractive conceptual framework to describe musical parameters which can be observed in improvisation, composition, and analysis.

There are other important writings in the general literature that have implication for assessment of creative thinking in music. Much of this work can be organized by noting the object of concern: either "process", "product", "person", or "environment".

In terms of process, the stage theory of Wallas is of importance (Wallas, 1926). He proposed that the creative process moves through four stages:

1. preparation -- the initial fragments of creative material are gathered and considered;

2. incubation -- time away from the creative task(s), allowing for the creator to live with the work while engaged in other enterprises;

3. illumination -- return to the creative work to discover some insight as to how the work might progress;

4. verification -- the continued refinement of the product and eventual presentation to society.

These four stages hold importance for us because they have been discussed in one form or another within several anecdotal accounts by creative persons in music and in many other disciplines (Winner, 1982).

From the literature on product assessment, Taylor (Taylor, 1959) suggested that the products of creative thinking might be viewed on different levels: expressive, productive, inventive, innovative, and emergenative. The expressive level represents spontaneous creative expression, the kind that might flow from the initial improvisation of young children such as those reported by Pond in the 1940's (Moorhead and Pond, 1978) or perhaps the very first sketches of a composer, artist, or writer. The second stage of productive creative thinking might relate to products that are technically adequate and are perhaps representative of a certain level of personal creative achievement, but do not display especially powerful meaning for the particular genre or domain. The inventive level, according to Taylor, would represent ingenuity as displayed with materials, methods and/or techniques. In the arts this might represent interesting and perhaps novel uses of an artistic parameter such as form or line, shape or rhythm, texture or space. The fourth and fifth levels of innovative and emergenative creative thinking involves increasing levels of products that hold special significance for a domain, with the emergenative level reserved for those products that fundamentally change a direction or point of view.

It is important to realize that this leveling theory is not necessarily meant to be viewed as a personal development theory in the sense of Piaget, but rather a more general view of creative achievement and development across a culture. Taylor felt that many people reserve the word "creative" for the fifth level only without consideration for the personal achievements that are characterized by the other levels. This myth of the "genius only" as a view of creativity is also addressed in more contemporary writings by Weisberg (1988) who argues persuasively against the over-romantization of "great insight" and "inspiration" as the driving force of creative achievement.

Taylor's approach to viewing creative products is useful for arts education because we must be realistic about where the creative expressions of our students fall in this hierarchy. Efforts to measure creative output may well reside at the expressive or productive levels during early stages of arts education and that is to be expected and encouraged. To put it simply, we are not in the business of identifying the next Mozart as much as in identifying creative potential in all children.

Sternberg, in his recently published book of collected essays on the nature of creativity, argues that "descriptions of the creative person typically fall into three general categories: cognitive characteristics, personality and motivational qualities, and special events or experiences during one's development." (Sternberg, 1988, p. 433). He is quick to point out that cognitive characteristics differ from one domain to another. In other words, those characteristics that might typify musicians are likely to be different from scientists or architects. He does, however, present a list of characteristics which are shared by creative people regardless of domain (see Table 1). This list is based on a summative analysis of the writings that are contained in his edited volume, but it does compare favorably with other lists by researchers in cognitive psychology.

Table 1
Common Traits, Abilities, Processing Styles
Sternberg, R. (Ed) The Nature of Creativity, p. 434

Traits

Originality
Articulate and verbally fluent
High Intelligence
Good imagination

Abilities

Creative in a particular domain
Thinks metaphorically
Uses wide categories and images
Flexible and skilled dicision maker
Makes independent judgments
Copes well with novelty
Thinks logically
Escapes perceptual set and entrenchment
Builds new structures

Styles

Asks "Why?"
Questions norms and assumptions
Alert to novelty and gaps in knowledge
Uses existing knowledge as a base for new ideas
Prefers nonverbal communication
Creates internal visualizations

What is interesting about this list is the division into three sets: traits, abilities and processing styles. It is this last grouping of styles--or ways in which creatives seem to approach problems--that holds special significance for assessment. I am especially intrigued by the style suggested by the last item: creation of an internal visualization--or what modern cognitive science might label mental imagery (Gardner, 1985, pp. 323-339). In music this relates directly to the ability to image sound and sound combinations in the mind during creative thinking. I believe this to be the process connected with the term "musical imagination" or what Edwin Gordon might call, "audiation." (Gordon, 1987) To me, this inner hearing represents the key to music education for creative thinking and perhaps the key to valid assessment.

Finally, in terms of both the "person" and the "environment", we should note the collective writings of Feldman, Csikszentmihalyi and Gardner as they focus on four sources of variables for analysis of creative thinking: subpersonal, personal, extrapersonal, and multipersonal.

The subpersonal relates to the "...biological substrate: the genetic endowment, the structure and functioning of the nervous system, various metabolic and hormonal factors, and the like." (Gardner, 1988, p. 301) For us in music, we are acutely aware of the nature/nurture issue. A certain disposition toward creative thinking in music might well be explained by a combination of genetic as well as environmental influences. This still remains as one of the great questions in psychology and education.

The personal level represents psychological characteristics such as factors of intellect and personality--much of what has been mentioned thus far in this talk. The third dimension labeled the extrapersonal, or what Feldman calls the "domain" of creative achievement, represents the sources of influence from the discipline itself--for us, music and the subdomains of composition, performance and analysis. This refers to an individual's understanding of, relationship with, and perhaps reaction against the body of knowledge, symbol systems, and basic assumptions of a domain. The fourth, multipersonal, represents the social, political and economic context in which the individuals find themselves working in a domain. This is the zeitgeist of the times, the environmental impact of, for example, war on artistic expression.

This more global view of the sources of variables on the creative thought process is valuable for us as educators. It also provides a more human context for assessment systems.

Music Literature

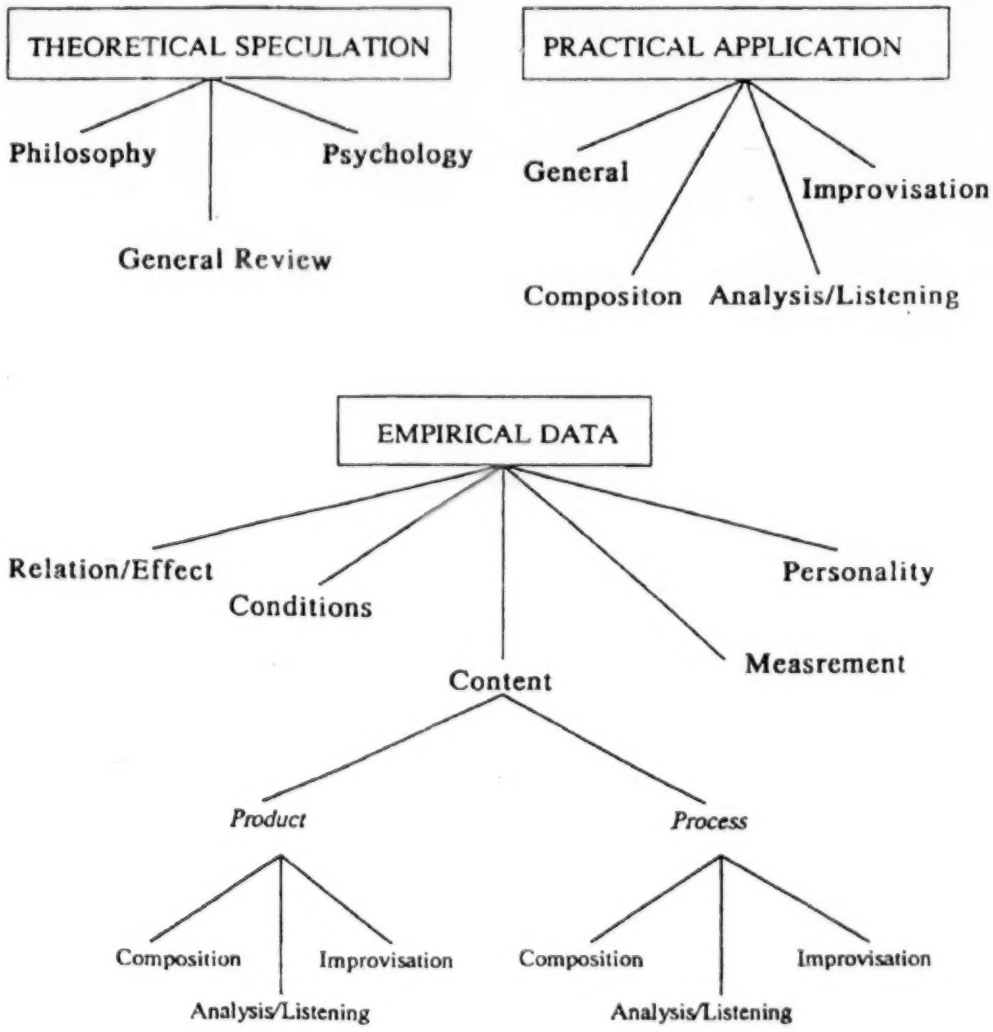
So far, we have cited non-music writings that hold promise for a better understanding of creative thinking in music. What of the literature in music itself?

Formal study of creative thinking in music by musicians has been slow to develop. Although a number of writers have commented in a personal sense about the creative process in music and have speculated about ways to encourage creative behavior, carefully designed studies that have sought to explain just what creative thinking in music is have not been plentiful. Much of the literature is in the form of short, speculative articles and exploratory research efforts by young scholars who have not developed their ideas in further research.

Fortunately, there is some evidence that this is changing. Music researchers, particularly those concerned with educational matters, are beginning to expand the conceptions of music aptitude and achievement by constructing methods for evaluating creative thinking potential (Webster, 1988a). Psychologists interested in matters of music cognition and artistic development are continuing to study creative abilities with greater intensity.

My own work in coming to grips with this music literature has resulted in an annotated bibliography of nearly a hundred and fifty citations. I have organized these writings into three broad categories: theoretical, practical, and empirical (see Figure 2).

Figure 2
Literature Model for Creative Thinking in Music
Related to Music Teaching and Learning



Each of these are, in turn, broken into subsets. For instance, theoretical writings seem best organized into psychological and philosophical work as well as general review articles. The practical literature seems best viewed by those product intentions upon which practical suggestions are offered (composition, improvisation, listening) and by a general category.

The empirical section is more complex. Here I have chosen sections that deal with:

1. the relationship between creative thinking ability and other variables and the effect that each has on the other;

2. conditions under which creative thinking occurs;

3. studies of personality and creative thinking ability,

4. content studies that explore the product and process of creative thinking in music by actual observation and analysis;

5. studies devoted to the measurement of creative thinking in music

A complete review of these studies would easily occupy all of my remaining time today. Regrettably, the uneven quality of this body of work would make the exercise suspect. However, I do wish to note several important writings that contribute to a foundation for valid assessment.

Theoretical

Perhaps the most important philosophical writing on creative thinking as it relates to music education comes from my colleague at Northwestern, Bennett Reimer. Reimer stresses the distinction between knowing music and being knowledgeable about music much like Sherman.

> The position taken in this book has been that what is humanizing about art is the experience of art rather than knowledge about art. When art is experienced aesthetically it gives, to the extent it is good art, as powerful as effective, as tangible a sense of human condition as is available to human beings.... The arts are humanistic to the extent they are directly known: to the extent they are aesthetically experienced (Reimer, 1989, pp.233-234).

Reimer argues for four ways that music education ought to bring people closer to the creative nature of music: 1) by using the most expressive music as possible in learning situations; 2) engaging people in the creative act itself, including composition, performance and listening; 3) stressing the elements of music and their interrelationship; and 4) focusing on musical behaviors that heighten the perception of the artistic qualities of the sounds themselves rather than extra-musical objects or techniques. (Reimer, 1989, pp. 69-73). Throughout the new edition of his book on the philosophy of music education, Reimer argues often for the centrality of creative activity to the mission of music education, especially in terms of composition--an activity he views as a new frontier for music teaching and learning. This placement of creative thinking in such a central role has great implications for our need to find valid and reliable assessment methods.

From the psychological side of the music literature, Aranosian speculates on the importance of a stream of musical consciousness and the need for encouraging spontaneous musical production at all levels of education (Aranosian, 1981). Drawing an analogy with language, he argues for a two channel approach to the creative process:

> The individual who makes a musical statement must initiate it, develop it with certain goals in mind, and conclude it. Again, two channels must be employed, so that the creator can develop ideas and maintain a sense of location and direction, while at the same time he/she can take the ideas produced and execute them either on a chosen instrument or in writing. As statements are presented in sequence, higher-level concepts are developed (Aranosian, 1981, p. 72).

He cites the self-reflective writings of many composers on this point and expands his view to include improvisation:

> The improvisor must also be attuned to this interface between the conscious and the preconscious. As the changes are being played by other ensemble members, the improvisor develops a line or a series of lines and chords which interlock with the changes in a deliberate way. He/she essentially lets the mind sing, while translating the internal auditory imagery into external music via the improvisor's chosen instrument. The lines are composed of fragmentary bits of music taken from the experiences and imagination which make up the pool from which the stream of consciousness flows (Aranosian, 1981, p. 75).

The emphasis here is on the ability to think while playing, to retain and/or develop ideas as they emerge from the stream of consciousness.

Aranosian continues by stressing that the traditional approach in music education has been skill-oriented, behavioristic and--using his term--"representational." He further argues that this is fine to a point:

> I wish to declare emphatically that I am not opposed to an emphasis on representational skill development in school music programs...The main thrust of my argument is that in no way is it sufficient to teach only technical skills and the history of their use, if we expect contemporary youths to make original or innovative use of these skills (Aranosian, 1981, p. 82).

The blend of representational and creative aims is a critical point, not only as an important implication for practice, but as a key to effective assessment and measurement techniques.

Practice

The literature on the practical application of creative thinking in music education settings is comparatively large, weighted largely toward classroom music settings. The Music

Educators Journal alone has accounted for over twenty such articles since 1960. Important monographs include books by Lasker (1971) on traditional composition techniques in the schools, together with Schafer (1979) and Paynter (1972) dealing with less traditional approaches. It is also possible to note aspects of creative thinking practice in each of the major texts on methodology such as those by Bessom (Bessom, et. al, 1974) and Regelski (Regelski, 1981) and in methodological approaches themselves such as Orff and Dalcroze.

Two major curriculum efforts have occurred dating from the 1960's, the Contemporary Music Project (CMP, 1966) and the Manhattanville Music Curriculum Project (Thomas, 1970). Both of these efforts are outstanding examples of how to place creative thinking strategies in the schools as a central focus of curriculum design. Manhattanville is an especially well organized approach which was designed on solid philosophical grounds and includes a number of practical suggestions in logical sequence for the general music program. The issue of student assessment is largely avoided, however, treated only in terms of self-analysis.

Considered as a whole this literature is important for measurement and assessment for it is often written by experienced teachers who have observed creative thinking in action and have thought about what they have seen. For instance Elizabeth Holderried, an elementary music specialist, writes:

> It all began when I decided to present some contemporary music to my sixth grade classes. This age group is usually characterized by a waning interest in musical activities, a decline in participation in singing, and an even weaker interest in listening to classical music and pursuing music reading. I wanted to propose a creative project that would require knowledge of the printed notes to be performed, using the playing of the instruments as the motivating factor. To arouse the children's interest, I chose two compositions by Edgar Varese -- Ionisation, for more than thirty percussion instruments, and Poeme Electronique, written for the 1958 World's Fair at Brussels. . . . I felt that this music would not shock them because of their exposure to movies and television, yet would arouse their curiosity about what instruments were used, how the sounds were made, and what effect the composer was trying to achieve. My guess proved to be correct far beyond what I had expected. The classes begged to hear the music again ... (Holderried, 1969, pp. 37-38).

She continues by outlining the activities of her class in creating several original compositions for class performance, using various classroom instruments. Her classes came together for a joint assembly to hear each others work. She writes:

> It was not a polished performance by any means; there were extra notes, instruments dropping to the floor, misplaced mallets, pieces of scenery falling down, and absent players. However, the classes waiting their turn gave their complete attention to the performing group. The children all knew what it was like to contribute to the

composition and to learn how to play a part correctly. Therefore, they felt exactly the way their classmates on stage did as they performed, and they watched to see if their friends succeeded in performance. Also, great curiosity had arisen by this time as to exactly what each class had composed. They listened so intently it was amazing (Holderried, 1969, p. 39).

Five gains in learning were noted:

1. contributions to a whole
2. development of music reading
3. knowledge of instruments
4. development of enthusiasm and interest toward music in general
5. values to the teacher

On this last point, she concludes:

> I have already hinted at the unbelievable success this musical approach had with the students--the tremendous excitement of both the class and myself as we wrote, changed, and decided. It was a freewheeling, wholly creative atmosphere and dialogue. There were no barriers; it was as if we communicated on a level that was neither adult nor child but creative artist. Perhaps words even fail to describe the experience as it <u>really</u> happened. The excitement was electrifying. I found myself hardly able to wait to get to my sixth-grade class--quite a contrast from other years. I learned that they have far more musical sense and judgment than they are given credit for. <u>They</u> knew what kind of sound <u>they</u> wanted, and they tested and rejected instruments for the proper effect until the right one was found (Holderried, p. 39, 1969).

I find this last quotation very powerful on many levels. Besides suggesting a change in the teacher's role from a <u>legislator of learning</u> to a <u>designer and active participant in learning</u>, and quite apart from the profound effect this had on the teacher's attitude toward her professional work, it also suggests a critical basis for assessment--namely the presence in the children of an inner sense of musical worth that must have come directly from the exercise of musical imagination. There seemed to exist a sense of musical "rightness" that can only be explained in the same way that adult composers explain their quest for the right flow of a melodic line or for just the right timbre.

Do all children have this? Can it be taught? Is it an aptitude or a set of aptitudes working

in consort? Can it be measured? Can we create assessment procedures that monitor its progress developmentally? To what might this ability be related? Endless questions for which little organized study has been devoted.

Another important example from the practical literature comes from a Canadian music educator, Margaret Galloway (Galloway, 1972). She documents her success in engaging eleven year old children in the composition and performance of a short opera based on the story of Peter Pan--complete with original script, dramatics and musical score! Important here is the classroom music environment in which this production occurred. Galloway writes that the children come to her classes knowing that they will be involved in one of four activities:

1. composing music and writing it down
2. improvising music alone or in a group
3. reading music to play or sing
4. learning about music

The creation and performance of a complete opera over a period of time became a natural outgrowth of the week to week activities of the class.

One of the important aspects of Galloway's account of her techniques involves record-keeping and I note it in this context of this talk because of its implication for assessment. She writes: "Each child is responsible for keeping up-to-date a file card with three headings: 1) what I know in music theory, 2) music I can play, and 3) my musical activities this year." (Galloway, 1972, p. 43).

This, together with a portfolio of composed pieces and tapes of improvised works might serve as an excellent model for musical assessment. Such portfolios are common place in the visual arts and in the educational systems of other countries such as England. One might imagine such a portfolio used in conjunction with traditional test scores in music aptitude and achievement and with newly devised measures of musical thinking that tap the musical imagination.

These examples have all been based on composition and set in the classroom. However, as the literature model suggests (see Figure 2), there are many contributions that deal with improvisation and listening which effect rehearsal hall, studio and classroom. A few of these hold special importance for assessment.

In a conceptual article on improvisation, Bill Dobbins writes that:

> The key to understanding the process of improvisation lies in the ability to experience a work of music as a fluid, ongoing development of sounds rather than as a static object fixed by a notated score. Each musical idea suggests its own potential for variation and development, which is realized through the course of the work,

> depending on the skill and sensitivity of the improviser (Dobbins, 1980, p. 37).

Again, using an analogy to language acquisition, Dobbins argues that certainly early study of a musical language involves imitation, but that often formal music education stops there. He writes:

> Reading music is merely what the term implies, whether it involves playing from a score or from memory. It is an important and necessary stage of development, but it is of little ultimate creative value if it does not lead to a capacity for spontaneous musical expression. The ability to play a Beethoven sonata or an Art Tatum solo is, by itself, no more an indication of musical creativity than is the ability to read a Shakespeare play an indication of the ability to use the language creatively. Even interpreters of classical music should be creative conversationalists, as well as readers, in the "languages" of the compositions they are interpreting. Otherwise, how can one hope to faithfully interpret the works of early composers who were known for their formidable improvisational skills (Dobbins, 1980, p. 37)?

Arthur Welwood continues this line of thinking by encouraging teachers to use "found sounds" for improvisation. He offers strategies just as call and response, antiphonal echoing, extended conversations--all with instruments such as refrigerator racks, old tools, bottles, plates, straws, boxes, rubber bands, and the human body and voice. He advocates a project-oriented approach to improvisation, often with playback, evaluation and discussion. He writes:

> The improvisations that result from these initial sessions with found instruments can be amazingly inventive. Often beautiful, free improvisation with delicate and fluctuating timbres result. A discussion and evaluation period should follow the sharing of all the groups. Topics should include student reactions, whether the work came out in performance as it had been planned, how each group decided what to do, the most exciting element in a work, combinations of sounds, and interesting rhythm patterns (Welwood, 1980, p. 74).

This sensitization to sound and its aesthetic properties is not far from the perspective offered by John Cage (1976) and Harry Partch (1975). Other writers who have approached this same issue in similar ways but with a greater attention to music of the young include Brian Dennis (1971), John Paynter (1972), Paynter and Aston, (1970) and R. Murray Schafer (1979).

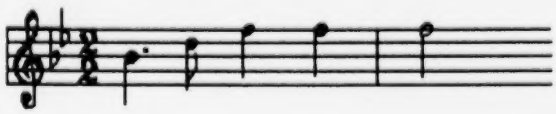
The importance of this literature in improvisation for assessment lies in the power of improvisation as a **means** to unlock the musical imagination in terms of demonstrated behaviors and, in so doing, offer a possible platform for measurement strategies. From a very young age, children can engage in improvisation without the need of extensive technical training. Such improvisation can also be structured, with tasks created that require the shaping

of sounds in ways that come close to compositional thinking. Evaluation of these performances by experts is possible, using musical criteria in sensitive ways.

Finally, an important and often overlooked aspect of creative thinking is creative listening. Saul Feinberg offers the profession an approach based on problem-solving and active, often projective listening (Feinberg, 1974). For example, he uses the concepts of fluency, flexibility, and elaboration to frame questions about listening that are not directive or prescriptive, but encourage divergency.

In terms of fluency, the following questions would be typical:

1) Before listening to the following music example (the opening section from Schubert's Symphony No. 5 in B flat), describe the different ways you think the main motif could be used in the music.



2) Three different themes will be played for you. After listening to them, pick out two that you think were written by the same composer and explain how they are related.

3) I will play two themes for you. If you were asked to compose a bridge connecting these two themes, how would you organize such a passage (Feinberg, 1974, p. 55)?

The listener is engaged in musical imagination as part of the listening experience. Another example would be tasks based on flexibility of thought. The "aural flexibility list" (see Figure 3) could be presented as the listener is asked:

> While listening to...the second movement of Hindemith's Symphonic Metamorphosis of Themes by Weber, place a check after any of the music qualities listed on your "Aural Flexibility List" whenever they reappear in the music (Feinberg, 1974, p. 56).

Figure 3
Feinberg, "Creative Problem Solving and the Music Listening Experience"
Music Educators Journal, 61 (1), p. 56

Music Qualities	Sections in the Music									
	1	2	3	4	5	6	7	8	9	10
a change in tempo										
a melody in a low register										
melody against melody										
thick dissonant chords										
a crescendo										
a sudden change in volume										
a solo wind instrument										
a percussion instrument										
pizzicato										
a new theme										
a return to the "A" theme										
a question-answer effect										
number of qualities heard										

Total

Such tasks encourage listening on multiple levels and attention to multiple aesthetic properties--consistent with divergent thinking ability.

Empirical

In this quick tour through the music literature, it is important to note some of the empirical studies. The two categories of studies that have the most significance for us are those that deal with content analyses and the measurement studies themselves (which will be discussed later.)

Perhaps the most interesting work in the field has come from the content portion of the empirical literature model--those studies that have looked at the product and processes of creative expression in music (largely in children) and have attempted to analyze the musical

characteristics. The ultimate hope of such research is to provide a sense of how the mind represents sound at various stages in development and how the music educator might benefit from this knowledge. Strategies involve engaging children in either compositional, improvisatory or quasi-improvisatory tasks, record the results, and study the musical characteristics. Unlike measurement efforts that are aimed at quantifying and comparing musical creative thinking abilities in a normative sense, these studies are essentially describing content. Obviously, these studies are important for anyone interested in assessment for they offer insights into musical mental imagery.

Moorhead and Pond (1978), Doig (1941), Freundlich (1978), Flohr (1979), Prevel (1979), Gardner (1982), Kratus (1985a), and Swanwick and Tillman (1986) have all studied the musical content of improvisations and compositions of children. Kratus (1985a) has summarized much of this literature in detail elsewhere, but I would like to make note of a few general findings.

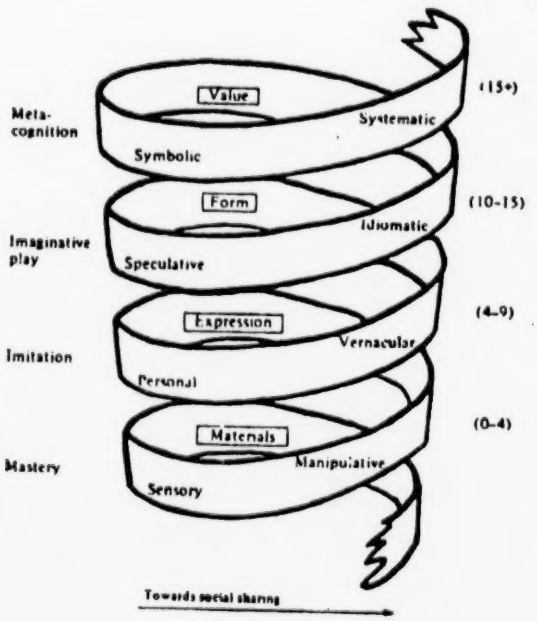
Until the age of five or six, children's rhythmic and melodic material is somewhat idiosyncratic, with no predictable pattern. It is unclear from the data if this is because of motor coordination problems in the production of sounds or if it is a true representation of inner hearing. After this age, both rhythmic and melodic structures seem to be more predictable. Between the ages of six and ten, changing or mixed meters occur, giving way to quite consistent patterns after age ten. Duple meter seems to predominate as the preferred in older children.

Again, after age five or six, the melodic and tonal characteristics become more pronounced. There is a gradual feeling for cadence structures evidenced in the music of children between six and ten, with also a growing awareness of tonal center within melodies. It seems clear that as children imitate the songs in their environment, their own music is influenced accordingly. After the age of ten, children become much more organized in terms of "rules", but not necessarily more original.

Another approach to musical content is to analyze the use of melodic and rhythmic motives. Kratus (1985b) asked eighty children, aged five, seven, nine, eleven, and thirteen, to create songs on a small, hand-held electronic keyboard. The children were given ample time to work on their compositions and recordings were then judged by a panel of musicians for content. Results suggested a general rise in the use of both rhythmic and melodic motive use from age five to eleven. Interest in the actual musical development of a melodic motive also rose to age eleven, however rhythmic development remained relatively unchanged at all age levels. Some drop off in thirteen year olds for motive use was noted, but it is unclear from the data if this is a real trend or a function of the particular sample.

Exploratory research by Swanwick and Tillman (1986) with British children between the ages of three and nine adds further to this literature. Their procedures of engaging children in improvisational activities with informal instruments followed similar lines to those reported above and yielded much the same results. What is especially interesting about their research report, however, is the inclusion of a speculative theory of creative musical development, based in part on their empirical work and on the writings of others. Figure 4 represents this model.

Figure 4
Musical Development Model for Creative Thinking
Swanwick and Tillman, "The Sequence of Musical Development"
British Journal of Music Education, 3 (3), p. 331



The four loops of the spiral represent increasing age levels of the child. The top level (Meta-cognition) represents the level most closely tied to adult creatives. The authors speculate about the musical distinctions between each level, basing this on the study of improvisations and compositions of 48 children. Some musical examples are given, but it is not clear how thorough this analysis is given the specificity of the model.

One very interesting aspect of the model is the inner movement within each loop. This inner movement (left to right) is described as a tendency in each stage to shift from the personal, individualized, egocentric and experimental to more schematized, social, conventional, derivative, and less original. In other words, the authors feel that as children develop in their musical understanding and awareness, there is a pendulum-like movement that swings between qualities of invention and convention.

Summary

So what does all of this mean for those interested in assessment? Several bases can be summarized which present a framework for assessment:

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Non-musical Literature

1) Cognitive traits or "factors" are useful in conceptualizing about intelligence, including musical intelligence. Examples for creative thinking in music include such traits as flexibility, fluency, and originality, as well as factors that relate to musical quality.

2) Creative thinking process can be viewed as progress through stages, specifically preparation, incubation, illumination, and verification.

3) It is possible to think in terms of levels of creative production, beginning with spontaneous responses and ending with profound discoveries.

4) Mental imagery or mental representation is an important stylistic feature of creative persons.

5) The sources for creative thinking might come from several variable sets, including biological, personal, professional (domain), and environmental.

Musical

6) Creative thinking in music is vital to the understanding of the art and its aesthetic base, therefore it should be of prime concern to music education, and in turn, in to valid assessment.

7) Any assessment attempts of creative thinking in music must include measures of both divergent and convergent thinking.

8) Musical imagination, viewed in terms of inner hearing, may well play an important role in assessment--in fact, be the most important factor.

9) The use of portfolios of creative thinking products in music as part of an assessment plan should be carefully considered, used together with a profile of scores on measures of creative thinking in music and more traditional measures of musical ability.

10) Improvisation offers an important means to evaluate creative thinking skills.

11) Musical content of improvisations and compositions of children differ with age level. The period between the ages 6 and 10 might be a suitable time for creative thinking assessment because it

comes after complete idiosyncratic behavior and before periods of literal representation

As you will soon see, these ideas have formed the basis for my own thinking about measurement design.

Measure of Creative Thinking in Music (MCTM)

Any assessment plan can be enriched with the proper use of valid measurement tools and this is certainly true of creative thinking in music. The Measure of Creative Thinking in Music (MCTM) was developed with the belief that creative thinking ability in music might be measured early in a child's musical development, between the ages of 6 and 10. Prior to the development of MCTM, there were examples in the literature of similar efforts but with older children.

Previous Studies

Using scoring factors that have their basis in the Guilford model, Vaughan (1971), Gorder (1976) and my own dissertation work (Webster, 1977) investigated creative thinking in music with children between the ages of 10 and 18. Using simple percussion instruments, Vaughan's measure asked subjects to play along with rhythmic and melodic ostinati, to answer rhythmic and melodic patterns, and to improvise an original piece of music. The criteria used to score the test were fluency, rhythmic security, ideation, and synthesis. Working with junior and senior high school students, Gorder used a similar approach by having subjects sing, whistle, or play on a familiar band or orchestral instrument. He asked subjects to continue a musical line begun by a motive and scored the results on criteria of fluency, flexibility, elaboration, originality, and musical quality. My own dissertation work also involved high schoolers, but was aimed at not just improvisation, but also composition and analysis skills.

This work is important historically, for it embodies many of the bases discussed above and serves as a platform for more contemporary approaches. In each case, however, they have not been used in more than one or two studies and do not present complete pictures of reliability and validity. In 1980, I became interested in improving the quality of this kind of measurement and decided to devote energy to a series of studies with younger children. With the support of a local funding program on children issues in Cleveland, I began work on MCTM.

MCTM Description

MCTM is not a paper and pencil measure, but rather a set of structured activities that must be given on a one-to-one basis. For this reason, it is not a practical measure in its present form for group testing but is more useful for selective administration and for research settings. Its intent is to evaluate expressive and productive levels of creative products (using Taylor's terminology) by engaging children in improvisatory and quasi-improvisatory musical activities

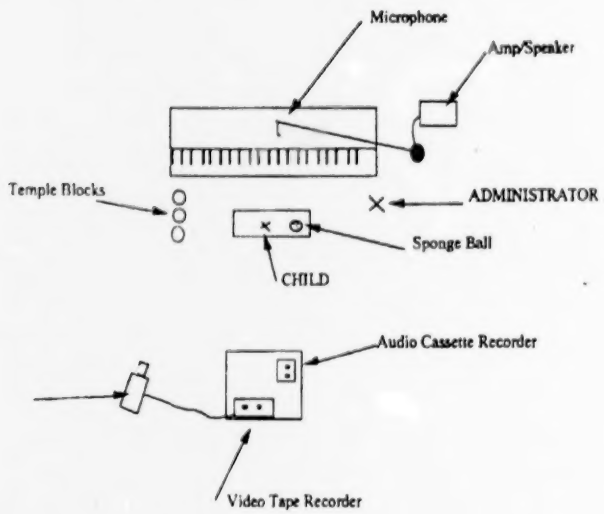
with simple but expressive musical instruments. Musical imagination is encouraged through divergent thinking tasks, but there is also a sense of structure that allows for measurement of musical order and meaning.

Equipment and Setting

MCTM uses three sets of instruments: 1) a round "sponge" ball of about 6" in diameter that is used to play tone clusters on a piano (either in a rolled fashion or as individual clusters), 2) a microphone that is suspended in front of the piano and is attached to an amplifier and speaker, and 3) a set of five, wooden resonator blocks (temple blocks) that produce different pitches when struck by a mallet. The instruments are all in easy reach and can be played easily by children who have had no musical training. There is a brief warm up period that is not scored and is designed to familiarize the children with the simple techniques necessary to play the instruments. All activity takes place in a private room with only the child and the administrator. All tasks are video taped unobtrusively and scored at a later time. It requires about 20 to 25 minutes to administer per child.

Additional equipment required includes: 1) a set of line drawings depicting space travel, 2) three pieces of blank paper, 3) an audio cassette player and blank cassette tape (re-usable for each child), and 4) a video camera and recorded with blank video tape in quantities suitable for the number of children to be tested. Figure 5 shows a suggested arrangement of the instruments and camera (seen from above).

Figure 5
Room Setup for Webster's
Measure of Creative Thinking in Music



Content

The measure consists of a series of 10 scored tasks, divided into three parts: exploration, application, and synthesis. Figure 6 displays the Scoring Summary Page and the list of tasks.

Figure 6
Scoring Summary Page for Webster's
Measure of Creative Thinking in Music

TASK	Musical Extensiveness (ME)	Musical Flexibility (MF)	Musical Originality* (MO)	Musical Syntax* (MS)
1 Rain Bucket		_____		
2 Elevator		_____		
3 Truck		_____		
4 Robot Song	_____	_____	_____	
5 Talking Blocks (Responses)	_____	_____		
6 Talking Blocks (Stimuli)	_____	_____	_____	
7 Frog Music	_____	_____	_____	_____
8 Space Pictures	_____	_____		
9 Space Voyage	_____	_____	_____	_____
10 Free Composition	_____	_____	_____	_____
Raw Totals	_____	_____	_____	_____
Standard Score	_____	_____	_____	_____

Standard Score Average _____

*If more than one judge is used, enter average rating for each task

The tasks begin very simply and progress to higher levels of difficulty in terms of divergent behavior. The atmosphere is game-like in nature, with no indication that there are any right or wrong answers expected. The text used by the administrator is standardized for all children and few models of performance behavior are given.

The exploration section is designed to help the children become familiar with the instruments used and how they are arranged. The musical parameters of "high"/"low", "fast"/"slow", and "loud"/"soft" are explored in this section, as well as throughout the measure. The way the children manipulate these parameters is, in turn, used as one of the bases for scoring. Tasks in this section involve images of rain in a water bucket, magical elevators, and the sounds of trucks.

The application tasks ask the children to do more challenging activities with the instruments and focus on the creation of music using each of the instruments singly. Requirements here ask that the children enter into a kind of musical question/answer dialogue with the mallet and temple blocks and the creation of songs with the round ball and the piano and with the voice and the microphone. Images used include the concept of "frog" music (ball hopping and rolling on the piano) and of a robot singing in the shower (microphone and voice).

In the synthesis section, the children are encouraged to use multiple instruments in tasks whose settings are less structured. A space story is told in sounds, using line drawings as a visual aid. The final task asks the children to create a composition that uses all the instruments and that has a beginning, a middle, and an end.

Scoring

The scoring of the video tapes involves both objective and subjective techniques. The scoring must be done by a professional who understands the factor meanings and can identify them in musical behavior. There are four factors used, each derived from theoretical literature and from content analysis sessions with a panel of experts from the fields of music composition, music education and psychology:

Musical Extensiveness -- the amount of clock time involved in the creative tasks

Musical Flexibility -- the extent to which the musical parameters of "high"/"low" (pitch); "fast"/"slow" (tempo) and "loud"/"soft" (dynamics) are manipulated

Musical Originality -- the extent to which the response is unusual or unique in musical terms and in the manner of performance

Musical Syntax -- the extent to which the response is inherently logical and makes "musical sense"

The factors of Musical Extensiveness (ME) and Musical Flexibility (MF) are measured objectively by either counting the actual seconds of time a child is involved in a task (ME) or by observing the manipulation of musical parameters (MF). This objective work can be done with a stop watch and direct observation of the video tape. In most cases, one observation is sufficient. However, if a response is a complex one, a second observation is sometimes necessary for proper scoring of MF. Figure 7 contains a sample page from the scoring forms which serves as an example.

Figure 7
Sample Scoring Page (ME, MF)
Webster's *Measure of Creative Thinking in Music*

Task 7 Frog Music -- ME

Record clock time in seconds from the beginning of the frog music until the end.

ME7: _____

Task 7 Frog Music -- MF

Follow guidelines described in Task 4 -- MF.

		Gradual Change
Soft/Loud	☐	☐
Fast/Slow	☐	☐
High/Low	☐	☐

MF7: _____

Task 8 Space Pictures -- ME

Record clock time in seconds for each of the three pictures. Combine for total.

ME8: _____

Task 8 Space Pictures -- MF

Consider the child's response for all three pictures. Award points for changes in each parameter for each instrument as described in Tasks 4, 5, and 6 MF, Boxes are provided below to record changes. (Total number of possible points: 17)

	PIANO		VOICE/MIC		TEMPLE BLOCKS	
		Gradual Change		Gradual Change		Gradual Change
Soft/Loud	☐	☐	☐	☐	☐	☐
Fast/Slow	☐	☐	☐	☐	☐	☐
High/Low	☐	☐	☐	☐	Five Blocks Used	☐

MF8: _____

Task 9 Space Voyage -- ME

Record clock time in seconds from the beginning of the space story until the end.

ME9: _____

Musical Originality (MO) and Musical Syntax (MS) should be evaluated by a panel of judges for best results, however, one observer is certainly possible. Rating scales based on carefully developed criteria are used for these factors. Some practice is necessary at first to achieve a sense of the proper rating categories. Once this is achieved, the scoring process becomes straight forward. In most cases, a rating for MO and MS can be assigned after two viewings. Figure 8 contains a sample page from the scoring forms which serves as an example.

Figure 8
Sample Scoring Page (MO, MS)
Webster's *Measure of Creative Thinking in Music*

Task 9 Space Voyage -- MO

Listen for unusual musical aspects of the performance. Consider:

1. Changing and/or unusual meters
2. Large and/or frequent dynamic contrasts
3. Changing tempi
4. Unusual use of the instruments
6. Unusual use of direction change
7. Unusually large and/or small intervals
8. Marked rhythmic complexity
9. Unusual use of words or sounds
10. Unusual musical combination and/or interchange between instruments
11. Unusual use of the body in playing instruments
12. Other musical aspects that seem unusual or particularly imaginative

Using the rating scale as defined in Task 4 - MO, rate the child's performance in terms of originality. For ratings of "3" or higher, briefly note the qualities that serve as the basis for your rating:

MO9: _____

Task 9 Space Voyage -- MS

Listen for the syntactical logic of the performance. Consider the following:

1. Sensitivity of musical materials to suit pictures
2. Feeling of logical movement from one large event or set of events to another
3. Return to a motive heard before
4. Elaboration through sequence and/or repetition or a rhythmic idea or melodic contour
5. Musical phrasing, with spots of relative repose
6. Complimentary rhythmic or melodic motion
7. Sensitivity to dynamics in relation to the whole
8. Awareness of instrument tone quality and this awareness used to shape the piece musically
9. Feeling of musical climax
10. Sense of overall form
11. Other musical aspects that contributed to syntactical logic

Using the rating scale as defined in Task 4 - MO, rate the child's performance in terms of syntax. For ratings of "3" or higher, briefly note the qualities that serve as the basis for your rating:

MS9: _____

Inexperienced evaluators are urged to view a random sample of children's performances in order to achieve an overall sense of the behavior patterns. This is especially important for proper evaluation of MO and MS. A careful review of the scoring sheets themselves will also help to direct the evaluator to key points of observation. For new evaluators, the scoring time necessary for one student performance might be as much as a full hour. However, with experience, forty to forty-five minutes is often the norm. Of course this time varies greatly with the length of the child's performance and the particular equipment used for playback.

The Summary Scoring Sheet (Fig. 6) indicates which tasks are scored for which factors. The user simply adds the scores in the factor columns for the total factor scores. These individual factor scores can be compared to normative tables or used in the establishment of local norms. The measure is designed to yield a set of scores--a profile that can be used in identifying strengths and weaknesses. A total score is possible, however, the user must convert each total factor score to a standard score and compute an average standard score across the four factors.

Reliability and Validity

Reliability and validity data have been collected in four studies to date (Webster, 1983, 1987, 1988a and Swanner, 1985). MCTM has also been used in a study of cognitive style by Schmidt and Sinor (1986). In terms of inter-scorer reliability for the factors of MO and MS, coefficients range from .53 to .78 with an average of .70. Internal reliability, measured in the form of Cronbach Alpha coefficients range from .45 to .80 with an average of .65 (.69 for the most recent version). Test-Re-test reliability indicates a range between .56 and .79 with the average of .76.

Content validity was established with a panel composed of music educators, composers, and psychologists which met on four different occasions to review the measure, audit pilot tapes, critique scoring procedures, and offer suggestions for improvement. To help establish construct validity, the scoring factors from the first administration of the measure in 1980 (Webster, 1983) were studied to determine feasibility of factor reduction. Factor analysis showed each factor significantly contributed to two global factors which represented the theoretical existence of convergent and divergent thinking. Some empirical validity exists in the form of significant correlations between music teacher ratings of divergent thinking and scores on the MCTM, although this has not been investigated extensively. All of the studies have shown a lack of correlation between measures of music aptitude and the MCTM, thus establishing a certain inverse validity.

Summary

This measure is, admittedly, a crude beginning. Its reliability, validity, and normative data area based on only about 300 students. Several hundred more subjects are required before the measure can achieve professional respect. The scoring procedures need continued refinement as well as the items themselves.

Yet, I remain optimistic that we are on the right track. The preliminary data is encouraging and the subjective reaction that I receive from researchers, teachers, parents, and the children themselves is positive. Perhaps most importantly, I believe that the measure is based on solid constructs, drawn both from the non-music literature and from the writings in music itself--many of which I have noted today.

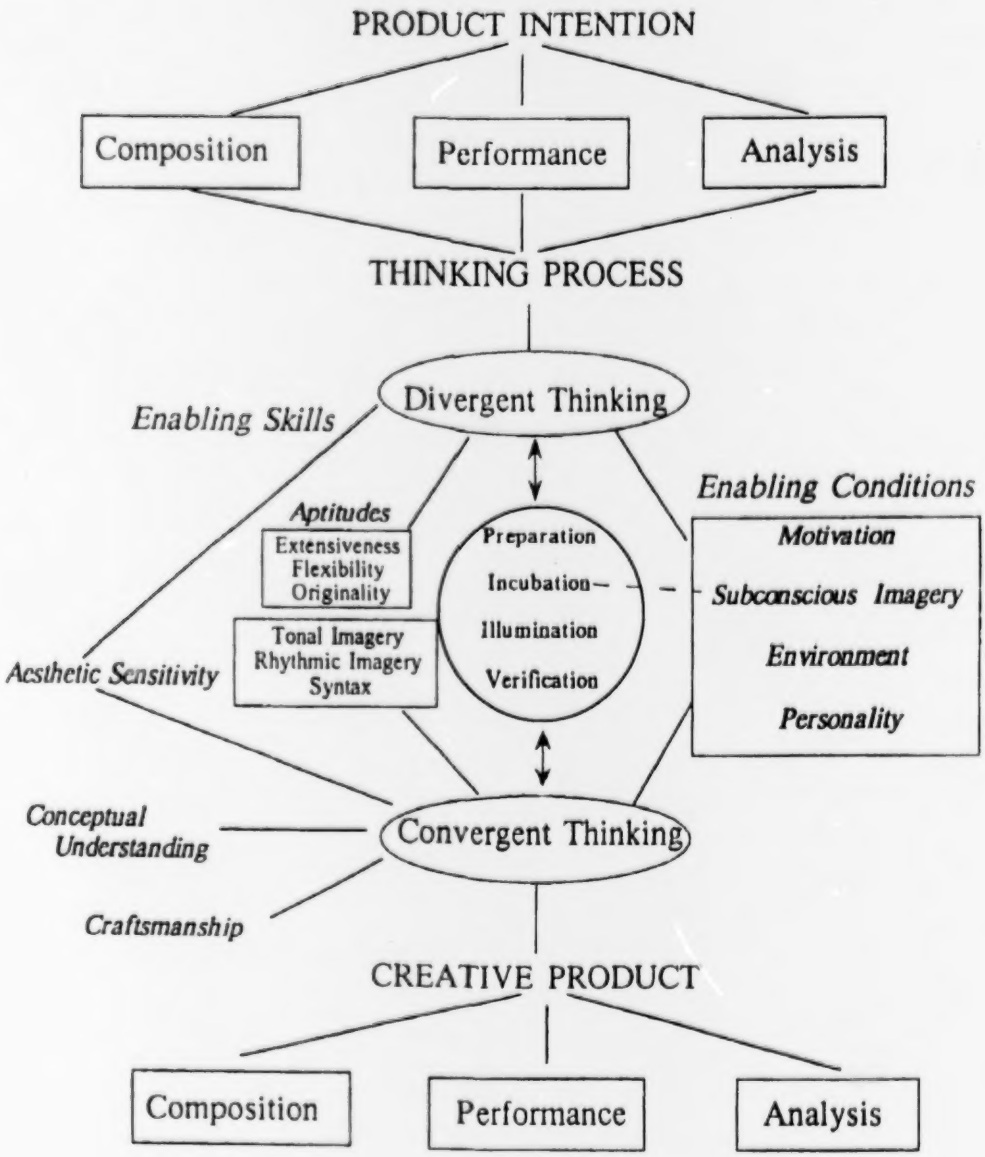
In recent times, I have become intrigued by how new advances in music and technology might impact on the effective use of MCTM. Would a computer generated version of the measure, implemented interactively with the user, be an answer to more efficient administration? Could one harness the power of sound sampling and MIDI software technologies to create an exciting and non-intimidating environment for the child? To offer some answers to these questions, I have begun work on a HyperCard application for the Macintosh computer that attempts to simulate the MCTM using synthesizer sound sources. Time will tell.

Of course, I intend to continue development of the traditional measure as well and welcome your participation. MCTM is available to anyone for the cost of materials only, provided that the measure be used in an effort to increase its validity.

Conceptual Model: Where It All Fits

I will end today with a brief look at where this all fits in the creative process itself. Where does measurement and assessment fit in to the total picture of creative effort? An answer can be found by viewing a conceptual model of the creative thinking process in music. The writings noted above and others like them have allowed me an opportunity to define creative thinking in music as **a dynamic process of alternation between convergent and divergent musical thinking, moving in stages over time, enabled by certain skills (both innate and learned), and by certain conditions, and resulting in a final product.** Figure 9 displays this process in graphic form.

Figure 9
Model of Creative Thinking in Music



I have discussed this conceptual model at length elsewhere (Webster, 1987), but I will briefly explain the major components. Composition, performance/improvisation, and analysis (written and listening) can be considered at the outset of creative thinking as goals or as "intentions" of the creator. At the same time, they represent the final product of creation. These intentions also help to define entrance and exit points in the model as seen in the top and bottom portions. Subtle differences in the process result from each product intention, however, the inner workings of the process are thought to be quite similar.

Enabling Skills

With the intention established, the creator must rely on a set of skills that allow for the thinking process to occur. These skills form the basis of a musical intelligence and interact with the thinking process in very rich ways. Figure 14 displays these skills as a group of four:

1) Musical Aptitudes: individual skills that are likely to be subject to great influence by the environment during the early years of development and possibly into early adult life. They include skills of tonal and rhythmic imagery (Gordon, 1979), musical syntax (sensitivity to musical whole), musical extensiveness, flexibility and originality (Webster, 1987).

2) Conceptual understanding: single, cognitive facts that comprise the substance of musical understanding

3) Craftsmanship: the ability to apply factual knowledge in the service of a complex musical task

4) Aesthetic sensitivity: the shaping of sound structures to capture the deepest levels of feelingful response--achieved over the full length of a musical work.

Enabling Conditions

In addition to personal skills which drive the creative thinking process, there are a number of variables to be considered that are not musical. These influences vary greatly from person to person and mingle with musical skills in delicate, complicated, and certainly profound ways. These "conditions" are listed on the right of the model and are explained below:

1) Motivation: those drives (both external and internal) that help keep the creator on task

2) Subconscious Imagery: mental activity which occurs quite apart from the conscious mind and that may help to inform the creative process during times when the creator is occupied consciously with other concerns.

3) Personality: factors such as risk-taking, spontaneity, openness, perspicacity, sense of humor, and preference for complexity that seem to exist in many creative persons and that may hold some significance for enabling the creative process

4) Environment: the host of characteristics of the creator's working conditions that contribute to the creative process, including financial support, family conditions, musical instruments, acoustics, media, societal expectations, and many others.

Thinking Process

The center of Figure 9 indicates movement between two types of thinking (Guilford, 1967) facilitated by stages of operation (Wallas, 1926). Connections between this process and the enabling skills and conditions are also noted.

In divergent thinking, imagination plays an important role and is fueled by the individual's conceptual understanding of the material itself. The obvious is noted, then placed "on hold" in favor of other possibilities--often without regard for tradition or common practice. At some point, however, this thinking process must cease in favor of a more convergent filtering. The mind must sift through the mass of possibilities in order to "create" a final solution.

Direct relationships between these modes of thinking and the enabling skills and conditions are noted on the model. The aptitudes of tonal and rhythmic imagery and musical syntax are most clearly connected to convergent thinking. Tonal and rhythmic imagery concern the ability to perceive sound in relation to change and involves the representation of sound in memory. Musical syntax is the ability to shape musical expressions in a logical manner according to patterns of musical repetition, contrast, and sequencing. In this sense, syntax is closely related to aesthetic sensitivity and is an early indication of this skill before extensive formal training. The aptitudes of extensiveness, flexibility, and originality are clearly connected to divergent thinking. Conceptual understanding directly impacts both divergent and convergent thinking. Since divergent thinking requires the mind to survey its "databanks" for possible musical content, it is reasonable to assume that the more that is there the better. It is impossible to expect individuals to think creatively if nothing is there to think creatively with--a common error in creative teaching strategy! It is also true that convergent thinking requires the continued development of a knowledge base. Craftsmanship and aesthetic sensitivity are also connected to convergent thinking because they require careful manipulation of musical material in sequential ways. Divergency is directly related to aesthetic sensitivity as well.

Summary

For me, assessment of musical creative thinking can occur at many points of the model. Certainly my measure (and others like them) can be used in assessing the enabling skills--especially aptitudes. Enabling conditions can be studied in other ways, perhaps with empirical methods such as those used in ethnographic research. The thinking process itself might be

explored with protocol analysis and with computer and video tape technologies. Finally, portfolios of creative products offer a relatively easy and powerful method of judging achievement.

In summary, assessment of creative thinking is not only possible, it should be required work of all who educate in the arts. We should realize now that "creativity" in its most general sense is not a mental disease, not driven by divine inspiration, not all kinds of musical behavior, not just bizarre thinking, not stifled by too much knowledge, not a mysterious process, not the same as general intelligence, not the same as traditionally measured musical aptitude, not just composition, and--most importantly--not so abstract and vast that it cannot be studied.

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